

Perceptions of Members of the American Association of Cereal Chemists Regarding Production of Whole Grain Foods

Kellie Chase, Marla Reicks, Purnima Srinivasan, and Len Marquart

This study assessed knowledge, attitudes, and normative and barrier beliefs of members of the American Association of Cereal Chemists about the production of whole grain foods. A total of 212 returned questionnaires were used in the analyses. Respondents had a fair knowledge of whole grain foods and positive attitudes about consumer-health and personal/company benefits. Scientific findings provided important normative influences for respondents from academia, while consumer needs and interests were influential for those in industry. Barriers included issues regarding consumer needs as well as beliefs about cost and product quality. Industry respondents may need to see stronger consumer demand before promoting production of whole grain foods.

Significant scientific evidence suggests that whole grains reduce risk for various types of chronic disease including heart disease, some cancers, type-2 diabetes and all-cause mortality (Slavin et al. 2001). Dietary guidance recently has emphasized increased consumption of whole grain foods (three servings daily) as recommended in the *Healthy People 2010 Report* (FDA/NIH 2000). In 1999 the FDA permitted a whole grain health claim under the Food and Drug Administration Modernization Act (FDA 1999) to encourage increased intake.

Data from the United States Department of Agriculture (USDA) 1994-96 Continuing Survey of Food Intakes by Individuals (CSFII) indicates that just 10 percent of those 20 to 59 years of age were consuming three or more servings of whole grains daily. For all population groups, yeast breads and breakfast cereals provided about two-thirds of the whole grain intake, with grain snacks such as crackers, pretzels, and popcorn accounting for one-fifth of total intake (Cleveland et al. 2000).

Cost and availability have been identified as general barriers to intake (Kantor et al. 2001). The availability of whole grain foods in the marketplace hinges on a lack of consumer demand versus industry costs to produce whole grain products and maintain an adequate return on investment. Consumers generally have both a poor understanding of and a poor overall interest in whole grain foods (Adams, Griffiths, and Reicks 2002). Most consumers cannot identify a whole grain food, lack knowledge about whole grain health benefits related to chronic-dis-

ease risk reduction, and do not know how many whole grain servings should be consumed daily. Given the lack of knowledge about whole grain foods on the part of the typical consumer, motivation by industry to produce whole grain foods may be low.

Engineering, product development, and marketing costs are inherent to a significant increase in production of whole grain foods by the grain industry (Marquart, Slavin, and Fulcher 2002). A better understanding of knowledge, attitudes, and normative and barrier beliefs regarding the production of whole grain foods by industry and academic leaders is needed to develop effective strategies to increase the availability of whole grain foods, which may in turn translate into increased consumption by the public. Currently there is little information available related to factors that influence the production of whole grain foods by industry and academic leaders. This study describes knowledge, attitudes, and normative and barrier beliefs regarding production of whole grain foods by members of the American Association of Cereal Chemists.

Methods

Subjects

A survey was developed and administered to assess knowledge, attitudes, and normative and barrier beliefs about production of whole grain foods of American Association of Cereal Chemists (AACC) members with a strong interest and/or expertise in the area of whole grains. At the 2002 AACC Annual Meeting in Montreal, Canada, 60 experts were asked to complete a questionnaire. Experts were defined as members who had contributed significantly to

Chase is graduate student, Reicks, is professor, Srinivasan is and Marquart is assistant professor, University of Minnesota, Department of Food Science and Nutrition, St. Paul, MN.

the whole grain field as a food or nutrition scientist, food developer, or administrator from the major sectors of industry, government, and academia. Experts were identified as those who published articles about whole grains in the scientific literature, were speakers on the topic of whole grain foods at recent conferences and symposia, were involved in the development of policy and regulatory statements, or were industry experts recommended through the AACC. To attract other unidentified members with an interest or expertise in whole grains, names and mailing addresses of 2,000 attendees from the 2002 AACC annual meeting were obtained. The survey instrument was mailed to these members along with a letter to obtain consent and a postage-paid return envelope. No incentive was provided directly to the subjects because it was thought that interest and expertise would motivate individuals to complete and return the survey instrument. However, one dollar was donated to America's Second Harvest foodshelf for each returned questionnaire.

Survey Development

Survey questions were based on previous literature (Marquart, Slavin, and Fulcher 2002) and the authors' past experience regarding whole grains related to industry, scientific, regulatory, technology, and consumer issues. Survey items included questions about demographic characteristics and experience with whole grain foods. Knowledge was assessed using five items based on correct responses regarding current dietary recommendations and consumption, components of whole grain foods, and prevalence of whole grain foods in the marketplace. Four attitude items related to health benefits of whole grain foods pertaining to bowel function, reduced risk for diabetes, heart disease and cancers were rated on a scale ranging from 'strongly disagree' to 'strongly agree.' Four additional attitude items related to perceptions of personal and company benefits that would result if the respondent were to participate in activities to promote production of whole grain foods were rated on a scale ranging from 'very likely' to 'very unlikely.' Perceptions of the strength of barriers to promoting greater production of whole grains foods were measured by asking questions related to three barrier subcategories (six cost items, five product-quality items, and five consumer-interest items) offering options from 'very difficult' to 'very easy.'

Normative beliefs were assessed as the likelihood that significant scientific or other findings would influence the promotion of greater production of whole grain foods (options ranged from 'very unlikely' to 'very likely'). These normative influences included superiors, peers, consumers, academics, government officials and scientific findings, and regulatory and policy statements. Cronbach alpha coefficients were greater than 0.71 for all scales and were considered acceptable (Nunnally and Bernstein 1994). Respondents were also asked how often they participated in various activities that promoted greater production of whole grain products. The survey instrument was pilot-tested among attendees at a local grain conference and revised based on issues regarding clarity and comprehension. The study was approved by the University of Minnesota Institutional Review Board: Human Subjects Protection Committee.

Data from the surveys were analyzed using SAS (SAS Institute, Inc. 2001). Descriptive statistics (demographics and percentages of participants responding in each response category) were used to describe demographic characteristics and attitudinal, normative, and barrier beliefs. Associations between variables were determined using Pearson correlation coefficients. The significance level was set at $p < 0.05$.

Results

Demographic Characteristics of Respondents

Demographic information is summarized in Table 1. A total of 212 questionnaires were returned (152 from the mail survey and 60 from the conference), resulting in a response rate of 11 percent. Of these, 163 (77 percent) said they have studied or worked with whole grain foods in the past five years. While the response rate was low, due to the nature of the sampling procedure it was thought that this sample would more accurately represent the overall scope of activities in the area of whole grains, based on the respondents' knowledge, attitudes, and beliefs, compared to the general population of AACC members. Data from this sample provide a better indication of the interactions among those highly involved in the field in terms of cost, quality, and consumer issues along with the influences of science, technology, and regulatory statements on whole grain production. The majority of respondents (53 percent) had

Table 1. Demographic Information.

Category	Characteristic	N	%
Degree	Associate	5	2.4
	Baccalaureate	40	19.2
	Masters	52	25
	Doctoral	111	53.4
Place of residence	Eastern United States	122	57.8
	Western United States	4	1.9
	Midwestern United States	63	29.9
	Other than United States	22	10.4
Years in field	5 or fewer	25	11.5
	6–10	42	19.4
	11–15	26	11.9
	16–25	55	25.3
	More than 25	63	29.0
Work setting	Manufacturer grain based products	46	21.9
	Manufacturer/supplier grain-based ingredients	37	17.6
	Manufacturer/supplier non grain-based ingredients	14	6.7
	Government, university, private sector	80	38.1
	Professional society, publisher	3	1.4
	Consulting firm	13	6.2
	Other	17	8.1

Note: N=212.

a doctoral degree. About 40 percent worked in a setting involving manufacturing or supplying grain-based products or ingredients; another 38 percent worked in a government or academic setting.

In response to items assessing knowledge about whole grain foods, only about 33 percent were able to correctly identify the number of recommended daily whole grain servings, while the majority correctly estimated typical whole grain intake. About 60 percent were able to identify the major components of a whole grain and correctly estimate the prevalence of whole grain products in the marketplace. However, only about half were able to identify the FDA health-claim criteria for a product to be considered whole grain.

Attitudes

Attitudes toward consumer health benefits of whole grains were very positive (Table 2) based on a scale mean of +4.9 (range: –8 to +8). More than 75 per-

cent of respondents agreed or strongly agreed that background research substantiates the benefits of whole grains for enhanced bowel function, and reduced risk of heart disease, diabetes, and cancer. The scale mean regarding perceptions of personal and company benefits was less favorable (+ 1.8 based on a range from –8 to +8). Approximately 45 percent and 51 percent indicated that it was likely or very likely that the activities would make money for the company and that participation in these activities would look good for the company, respectively, while 80 percent indicated that participation was likely or very likely to promote public health. Only 25 percent reported that participation was likely or very likely to result in personal recognition.

Barrier Beliefs

Factors were identified as barriers if respondents indicated that the factors would make it very difficult or difficult to participate in activities that pro-

Table 2. Means and Correlation Coefficients between Variables Based on Statements about Whole Grain Products.

Statement about whole grain products	Mean \pm SD	Health benefits	Personal/company benefits	Barrier beliefs	Cost	Product quality	Consumer interest	Normative beliefs
Health benefits ¹	4.9 \pm 3.0	--						
Personal/company benefits ²	1.8 \pm 2.9	0.300***	--					
Barrier beliefs ³	-2.5 \pm 9.9	0.167*	0.438***	--				
Cost	-0.61 \pm 4.0	0.137*	0.336***	0.725***	--			-
Product quality	-0.41 \pm 4.4	0.089	0.306***	0.801***	0.373***	--		
Consumer interest	-1.4 \pm 4.4	0.092	0.296***	0.774***	0.326***	0.434***	--	
Normative beliefs ⁴	0.6 \pm 6.7	0.265**	0.341***	0.188*	0.155*	0.169*	0.212**	--

* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.0001$

¹Health benefits: mean of four items (bowel, cancer, heart disease, diabetes) with a scale of strongly disagree (-2), disagree (-1), neither disagree nor agree or do not know (0), agree (+1), strongly agree (+2), for a possible range of -8 to +8, (Cronbach alpha: 0.89).

²Personal/company benefits: mean of four items (\$ company, company recognition, public health, personal recognition) with a scale of very unlikely (-2), unlikely (-1), neither unlikely nor likely or not applicable (0), likely (+1), very likely (+2), for a possible range of -8 to +8, (Cronbach alpha: 0.71).

³Barriers beliefs: overall mean of 16 items in three barrier subcategories (6 cost items, 5 product-quality items, and 5 consumer-interest items) with a scale of very difficult (-2), difficult (-1), neither difficult nor easy or not applicable (0), easy (+1), very easy (+2), for a possible range of -32 to +32, (Cronbach alpha: 0.95).

⁴Normative beliefs: mean of eight items (peers, superiors, etc.) with a scale of very unlikely (-2), unlikely (-1), neither unlikely nor likely or not applicable (0), likely (+1), very likely (+2), for a possible range of -16 to +16, (Cronbach alpha: 0.83).

moted production of whole grain products (Table 2). Means of all barrier-belief scales were slightly negative. Respondents were most concerned about consumer issues and least concerned about cost as barriers. More than 40 percent of respondents indicated that barriers included low consumer awareness of products, low intake, consumer inability to identify whole grain foods, and limited marketing of whole grain products. Only about 20 to 30 percent indicated that cost issues such as the cost of new equipment, the cost of plant start-up, training and pilot-plant costs, and time and cost of R&D were barriers. Sourcing costs for suitable type and availability of whole grains were considered a barrier by fewer respondents (15 percent). Other barriers for about one-third of respondents were related to product quality issues such as stability, taste, texture, flavor, and color. All three subcategories regarding barriers (cost, product quality, and consumer interest) were highly correlated with the overall barrier scale.

Normative Beliefs

Several normative influences existed for respondents, which differed according to work setting. The most influential for the overall group of respondents was scientific findings, followed by consumer interests. When the respondents were divided by work setting, those in industry were more likely to indicate that consumers were important influences, while those in academia were most influenced by scientific findings. Regulatory statements and policy also reportedly influenced both groups.

Participation in Whole Grain Production Activities

Respondents reported that over the past year, they had discussed whole grain science (55 percent), discussed whole grain technology (47 percent), worked on whole grain products (46 percent), discussed whole grain consumer issues (40 percent), conducted whole grain research (37 percent), advocated whole grain issues or products (26 percent), discussed regulatory issues (26 percent), and marketed whole grain products (20 percent).

Relationship Between Scaled Variables

The perception of consumer health benefits was modestly correlated with perceptions of personal or company benefits ($r=0.300$, $p<0.0001$). The perception of personal or company benefits was also modestly correlated with all barrier-belief scales as well as the normative-belief scale.

Implications

This study assessed knowledge, attitudes, and normative and barrier beliefs of industry and academic experts who may be able to influence the promotion of increased production of whole grain foods. The results of this study indicated that the ability of respondents to promote production of whole grain products is mediated through internal (superiors and consumer interests) as well as external (scientific findings and regulatory and policy statements) influences. Industry members of the AACC were influenced more by consumer interests and needs than were academics, who were influenced primarily by scientific findings.

Consumer issues were believed to present more significant barriers than were cost and quality of products. This suggests industry is not willing to manufacture whole grain foods nor to create a market until consumer demand warrants a higher probability for success in meeting those needs. From a consumer-marketing perspective, the way consumers think about whole grains may influence their food choices at the point of purchase, in the home, and in away-from-home eating occasions. The concept of "whole grain" is not well defined or conceptualized by consumers and health professionals (Adams, Griffiths, and Reicks 2002). A clear understanding of the term "whole grain" is necessary in the development of definitions for research, education, and marketing of whole grain products. In contrast, a clear understanding of the definition and meaning of fruits and vegetables by consumers and health professionals has provided a foundation for building successful interdisciplinary programs such as the 5 A Day Program (Stables et al. 2001).

The development of whole grain food products with good taste and favorable palatability is perhaps the most important factor contributing to enhanced consumer desirability. Little effort has been made by food manufacturers to create and develop whole

grain foods that are highly desirable. Respondents in our study indicated that there would be moderate difficulty in overcoming quality issues related to greater production of whole grain foods. Significant improvement must be undertaken either in innate quality characteristics such as color, flavor, and texture or by novel processing techniques to develop desirable whole grain foods. The use of white whole wheat is becoming more popular. Grain products made with white whole wheat flour are lighter in color, milder in flavor and lighter in texture than are traditional products made with red whole wheat flour. These characteristics are consumer-friendly and increase the acceptability of whole grain foods (Symns and Cogswell 1991). Consideration should also be given to the gradual increase in the level of whole grain flour added to various grain foods, thus increasing whole grain consumption by consumers (Ujjasz et al. in press).

Overall, increased production of whole grain products is not perceived by respondents as a primary means to make money for the company. It has been suggested that whole grain patents, exclusivity and proprietary products are more difficult to secure and execute in the market (Marquart, Slavin, and Fulcher 2002). The general belief is that whole grains will cost more in sourcing, capital investment for new equipment, training of employees, production, consumer insights and marketing of whole grain foods. However, in the current study, costs for sourcing were not indicated to be as large a concern as were other development issues.

If whole grain consumption is to be increased, industries that manufacture and market whole grains must undergo changes at virtually every point in the supply chain, from farm to table. This paradigm shift will require a new approach to grain sourcing, engineering, product development, and other costs inherent to the change. Processing facilities and equipment required to process and produce whole grain food products would need to be reconfigured. Adaptations include training of personnel and altered processing times and storage facilities. The added volatility of whole grains will necessitate adaptations in the transportation, warehousing, and shelf-life of products.

One of the strengths of this study was the recruitment of experts in the area of whole grains and health. This group was more likely to understand the broad perspectives and inter-relationships among the various sectors (government, industry,

academia), business objectives, and science, technology, regulatory, and consumer issues. A limitation was a lack of a broad representative sample of individuals in the grain field to assess general knowledge, attitudes, and beliefs. A next step is to examine knowledge, attitudes, and beliefs in a representative sample of individuals working in the grains field involving a variety of sectors.

This research provides preliminary information to increase our understanding of the factors that may influence experts in the area of whole grains and health. Industry has the opportunity to take the lead in the development of desirable whole grain foods that can be identified by consumers in the market place. The combination of educating consumers about the identification, practical use, and health benefits of whole grain intake coupled with an improvement in the availability and acceptability of products in the marketplace holds the greatest promise for meaningful change in consumer practices. There is much work to be done--involving a coordinated effort by academia, government, industry and trade, and health-related agencies--if we are to meet the Healthy People 2010 dietary goal of consuming three servings of whole grains per day.

The perception of personal or company benefits is linked to barrier beliefs. Therefore, methods that will overcome barriers related to consumer appeal are needed throughout the supply chain. The issues surrounding the influence of supervisors and peers on industry members regarding whole grain product development require additional study.

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